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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/212,726

12/15/1998

KLAUS F. SCHUEGRAF

M122-1098

7984

21567

7590

09/27/2004

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EXAMINER

KIELIN, ERIK J

ART UNIT

PAPER NUMBER

2813

DATE MAILED: 09/27/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/212,726

Applicant(s)

SCHUEGRAF, KLAUS F.

Examiner

Erik Kielin

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 July 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 60-64, 66-68 and 70 is/are pending in the application.
- 4a) Of the above claim(s) none is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 60-64, 66-68 and 70 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

This action responds to the Amendment filed 22 July 2004.

Claim Rejections - 35 USC § 112

1. Claims 60-64, 66-68 and 70 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The specification does not provide support for the negative limitation, “without feeding added ozone into the chemical vapor deposition reactor.” The specification wholly fails to address ozone. The evidence indicates that Applicant did not have possession of knowledge as to how ozone may or may not impact the instant process either positively or negatively. Accordingly, this new limitation amounts to new matter.

In the interest of customer service, should Applicant wish to eliminate ozone in the reaction gas mixture, the proper course of action is to recite “consisting of” in the preamble and include all limitations in a single claim **that are supported by the instant disclosure** --not to use unsupported negative limitations.

Additionally, the specification does not support the limitations “to directly deposit SiO₂” or “the SiO₂ being formed during the directly depositing.” The evidence of record indicates that silanol, at best, Si(OH)₄ will be deposited --not SiO₂-- since the specification indicates that H₂O and H₂O₂ are used as oxidants of the TEOS. Moreover, the specification is only directed to

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reduction of intermediates associated with the precursor directly in other words, mono-, di- and tri-ethoxy silanols --not elimination. Further in this regard, the specification indicates that the problem with the prior art decomposition of TEOS is that it is difficult for the **intermediates** to reach the bottom of high aspect ratio openings thereby providing poor conformality. In this regard, the specification states, in pertinent part at p. 2, line 9 to p. 3, line 13,

“Typically, however, **intermediates** are formed in the above reaction which include di-ethoxysilane ($\text{Si}(\text{OC}_2\text{H}_5)_2(\text{OH})_2$) and tri-ethoxysilane ($\text{Si}(\text{OC}_2\text{H}_5)_3\text{OH}$). Further, other reaction by-products are formed...”

“One source of inadequate conformality of SiO_2 on a substrate surface is premature formation of **undesirable intermediates which react to form SiO_2 at higher topographical elevations** on a substrate surface. Consequently, such **intermediates never reach the bottom** of a particular substrate feature, such as trench 12 of Fig. 2, **so that lesser degrees of SiO_2 are formed thereon.**” (Emphasis added.)

It would appear, then, that the solution to the problem in the instant invention would intend to get such “intermediates” to reach the bottom of the openings not to directly deposit SiO_2 . Moreover, the specification fails to support the direct formation of SiO_2 in the gas phase from the intermediates formed prior to deposition on the substrate.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this

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subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 60-64 and 66-68 are rejected under 35 U.S.C. 102(b) as being anticipated by US 5,360,646 (**Morita**) considered with **Wolf**, et al. Silicon Processing for the VLSI Era, Vol. 1-Process Technology, Lattice Press: Sunset Beach CA, 1986, pp. 166-167, for a showing of inherency only.

Regarding claim 60, **Morita** discloses a semiconductor processing method of depositing a SiO₂ layer comprising,

providing a substrate 60 within a cold-wall, chemical vapor deposition (CVD) reactor 300 (Figs. 1-3; col. 3, line 20);

feeding a gaseous silicon precursor (TEOS for example) into the CVD reactor (col. 3, line 17; Figs. 2-3);

feeding gaseous H₂O₂ into the CVD reactor without feeding ozone into the reactor (Figs. 2-3; col. 4, line 49 to col. 5, line 48); and

utilizing the silicon precursor, directly depositing a layer of SiO₂ over a surface of the substrate the SiO₂ being formed during the direct depositing (col. 4, lines 24-62).

It is seen to be inherent that the reactor of **Morita** is a cold-wall reactor, because the heating of the wafers is via the heater 50 located beneath the wafers (**Morita**, Figs. 1-3; col. 3, line 26). **Wolf** at pages 166-167 indicates that when the heating comes from within the reaction chamber, that the reactor is called a "cold-wall" reactor, as compared to a "hot-wall" reactor wherein the heating elements are located external to the chamber.

Regarding claim 61, **Morita** discloses that the gaseous precursors are independently fed into the CVD reactor (Figs. 2 and 3) via sources 70 and 80.

Regarding claim 62, **Morita** discloses that the precursors are fed into the CVD reactor simultaneously (Figs. 2 and 3).

Regarding claim 63, **Morita** discloses that the gaseous H_2O_2 and the gaseous silicon precursor are comprised by a gaseous mixture that is fed into the chemical vapor deposition reactor (Figs. 2 and 3).

Regarding claim 64, **Morita** discloses that gaseous H_2O is also fed into the CVD reactor at least because the maximum concentration available is 98% H_2O_2 and because H_2O_2 decomposes into H_2O and O (col. 4, lines 49-60).

Regarding claim 66, **Morita** discloses that the substrate 60 has a high aspect ratio and that the SiO_2 is conformally deposited, by definition, stating “[t]he method is capable of producing excellent step coverage on substrate with steep step portions” (Abstract).

Regarding claim 67, **Morita** discloses that the gaseous precursor may be at least TEOS (Figs. 1-3).

Regarding claim 68, **Morita** discloses that the deposition temperature may be about 400 °C (col. 5, Table II).

4. Claims 60-64 and 66-68 are rejected under 35 U.S.C. 102(e) as being unpatentable over US 5,710,079 (**Sukharev**) considered with **Wolf**, et al. Silicon Processing for the VLSI Era, Vol. 1-Process Technology, Lattice Press: Sunset Beach CA, 1986, pp. 166-167, for a showing of inherency only.

Regarding claim 60, **Sukharev** discloses a semiconductor processing method of depositing a SiO_2 layer comprising,

providing a substrate **101** within a cold-wall, chemical vapor deposition (CVD) reactor **300** (Figs. 1 and 3);

feeding a gaseous silicon precursor (TEOS for example) into the CVD reactor (col. 3, lines 50-65);

feeding gaseous H_2O_2 into the CVD reactor (col. 3, lines 50-65); and

utilizing the silicon precursor, directly depositing a layer of SiO_2 over a surface of the substrate the SiO_2 being formed during the direct depositing (col. 3, lines 50-65).

While **Sukharev** uses ozone, Applicant fails to provide support for the negative limitation of without feeding ozone into the CVD chamber, accordingly the reference of **Sukharev** still reads on the claimed features for which there exists support in the specification.

It is seen to be inherent that the reactor of **Sukharev** is a cold-wall reactor, because the heating of the wafers is via the susceptor (Sukharev, col. 6, lines 24-31). **Wolf** at pages 166-167 indicates that when the heating comes from within the reaction chamber, that the reactor is called a “cold-wall” reactor, as compared to a “hot-wall” reactor wherein the heating elements are located external to the chamber.

Regarding claim 61, **Sukharev** discloses that the gaseous precursors are independently fed into the CVD reactor (Fig. 2).

Regarding claim 62, **Sukharev** discloses that the precursors are necessarily fed into the CVD reactor simultaneously (col. 3, lines 55-59).

Regarding claim 63, **Sukharev** discloses that the gaseous H_2O_2 and the gaseous silicon precursor are comprised by a gaseous mixture that is fed into the chemical vapor deposition reactor (col. 3, lines 55-59).

Regarding claim 64, **Sukharev** discloses that gaseous H₂O is also fed into the CVD reactor (col. 3, lines 55-59).

Regarding claim 66, **Sukharev** shows that the substrate **101** is shown to have a high aspect ratio and that the SiO₂ is conformally deposited, by definition, since the SiO₂ film “conforms” to the surface (Fig. 1).

Regarding claim 67, **Sukharev** discloses that the gaseous precursor may be at least TEOS (col. 3, lines 55-59).

Regarding claim 68, **Sukharev** discloses that the deposition temperature is preferably 400 °C (col. 6, lines 24-27).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claim 70 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Morita** considered with US 4,843,867 (**Cummings**) for a showing of the inherent vapor pressure of H₂O₂.

The prior art of **Morita**, as explained above discloses all of the limitations of the instant invention, but does not teach the claimed concentration range of 5-15% H₂O₂. **Morita** discloses a bubbler of H₂O₂ with an O₂ carrier gas of 500 to 4000 sccm (Table II in col. 5). Assuming the concentration of H₂O₂ is 98% (col. 4, lines 50-53 of Morita) and given the vapor pressure of

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H₂O₂ is about 4 Torr (1 Torr = 1 mm Hg) at about 35 °C (as interpolated between the 30 °C and 40 °C data points in Table 1 in cols. 5-6 of Cummings), the partial pressure of H₂O₂ in the O₂ carrier would be about 4 Torr or about 0.53% in the O₂. So the final concentration of H₂O₂ is about 0.26% to about 0.42% depending upon the flow rate of carriers O₂ and N₂ used.

While this concentration range does not overlap the presently claimed range of 5% to 15%, the concentration range for H₂O and/or H₂O₂ indicated in the instant specification to provide conditions "which are effective to reduce formation of undesired reaction intermediates" --the object of the invention-- range from **less than** 0.5% to 50% (see specification page 12, lines 3-13) and therefore overlap those in **Morita**. In this regard, it has been held that choosing parameters within or near ranges taught by the prior art is *prima facie* obvious. See *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976). See also *In re Huang*, 40 USPQ2d 1685, 1688(Fed. Cir. 1996)(claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). As per precedent, then, it would have been obvious to choose a concentration with 5% and 15% because **Morita** discloses an exemplary range near the claimed range, and there exists no evidence of record to the criticality of the range **now** claimed in instant claim 70.

7. Claim 70 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Sukharev**.

The prior art of **Sukharev**, as explained above discloses all of the limitations of the instant invention, but does not teach the claimed concentration range of 5-15% H₂O₂. Instead, **Sukharev** discloses ranges of 0.5 to 3% H₂O and 0-3% H₂O₂. However, it has been held that

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choosing parameters within or near ranges taught by the prior art is *prima facie* obvious. See *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). Therefore, it would have been obvious to choose a concentration with 5% and 15% because **Sukharev** discloses a range near the claimed range, according to the precedent set by *In re Wertheim* or *In re Huang*. Moreover, the concentration range for H₂O and/or H₂O₂ indicated in the specification to provide conditions “which are effective to reduce formation of undesired reaction intermediates” --the object of the invention-- range from less than 0.5% to 50% (see specification page 12, lines 3-13) and overlap those in **Sukharev**, e.g. 0.5 to 3% H₂O and 0-3% H₂O₂. Accordingly, there exists no evidence of record to the criticality of the range **now** claimed in instant claim 70.

Response to Arguments

8. Applicant's arguments filed 22 July 2004 have been fully considered but they are not persuasive.

Applicant argues that there exists support in the specification for the negative limitation of while no feeding ozone into the reaction chamber. Examiner respectfully disagrees for reasons of record in the rejection which are incorporated herein their entirety.

Further in this regard, Applicant points to MPEP 2163.04 and 2163.02 for support for the inclusion of the negative limitation. In regard to MPEP 2163.04, Examiner provided a rather detailed basis in support of the inadequacy of the written description in the Office action filed 22

April 2004, as maintained and repeated above in the present Office action. Applicant, by contrast, has failed to demonstrate wherein the specification one of ordinary skill would know Applicant was in possession of specific exclusion of ozone, given the disclosure. Moreover, the **Morita** reference (US 5,360,646) teaches that each of ozone and H_2O_2 decompose to form active atomic oxygen (col. 4, reactions labeled (6) and (8)). Accordingly, one of ordinary skill would not be informed of any art-known reason to omit ozone when ozone provides the active oxygen, just as does H_2O_2 . This provides additional support contrary to Applicant's argument regarding the support for omission of ozone. For at least these reasons, the argument is not persuasive.

In regard to MPEP 2163.02, Examiner believes that this supports the reasoning behind the rejection of the claims under 35 USC 112(1), new matter. The case law presented in this section clearly indicates that Applicant must be in possession of the invention --at the time of the invention. As Applicant makes absolutely no note of omission of ozone, it is unclear how Applicant can believe he was in possession of this at the time the invention was filed. There exists no evidence of record the presence or absence ozone, known to produce active atomic oxygen (Morita) would somehow produce a different results. For at least these reasons, the argument is not persuasive.

Regarding the rejection of the claims under 35 USC 112(1), new matter for the limitation, "to directly deposit SiO_2 " and "the SiO_2 being formed during the directly depositing," Applicant argues that there exists support at p. 9, lines 4-8 of the instant specification and in the claims originally filed. Examiner respectfully disagrees. Neither the specification nor the original claims mentions direct deposition of SiO_2 , explicitly, implicitly, or inherently. The decomposition of TEOS into SiO_2 does not necessarily occur directly during deposition as made clear in

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Applicant's own specification at p. 2, line 9 to p. 3, line 13, the lines recited above in the rejection of the claims. Specifically, the TEOS and its intermediates may absorb on the substrate and then react. In fact, Applicant claims a **cold-wall reactor** which necessarily means the source of heat used to carry initiate the reaction of TEOS with the active oxidizing agent comes from the substrate via the susceptor holding the substrate; therefore, absorption of the TEOS and its intermediates onto the substrate is more likely the path of reaction toward the final product of SiO₂. Accordingly, the deposition of the SiO₂ is more likely subsequent to absorption than directly as SiO₂. Because direct deposition of SiO₂ is not an inherent feature, Applicant **cannot** now incorporate this into the specification or the claims.

Applicant's arguments regarding the rejection of the claims under 103 are moot in view of new grounds of rejection.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,


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however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 571-272-1693. The examiner can normally be reached on 9:00 - 19:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Erik Kielin
Primary Examiner
22 September 2004